Lifetime of a Disoriented Chiral Condensate*

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The lifetime of a disoriented chiral condensate (DCC) [1] formed within a heat bath of pions is calculated assuming temperatures and densities attainable at present and future heavy-ion colliders. Generalizing the the LSZ-reduction formula to include coherent states we can express the decay rate in terms of measurable matrix-elements.

$$\frac{1}{N}\frac{dN}{dt} = \frac{1}{2E_0}\int d\tilde{k}_1\, d\tilde{k}_2\, d\tilde{k}_3\, (2\pi)^4\delta^4(\Sigma\, k_i)\, F_{123}\, \langle|\mathcal{T}_{\pi\pi}|^2\rangle\,.$$

Using measured transition matrix-elements for pion-pion scattering and pion-nucleon scattering as well as resonance saturation for pion-rho scattering we predict the half-life about 7 fm/c for thermal pion densities at temperatures of about 150 MeV.

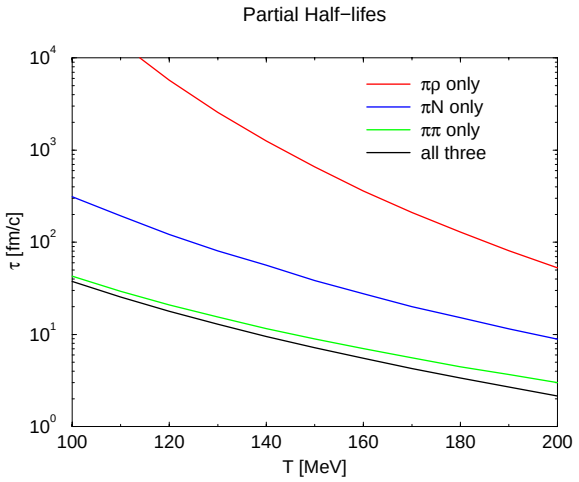

Figure 1: Different contributions to the DCC-lifetime.

We find that the effect of higher resonances as well as that of nucleons is small (see figure 1). In figure 2 we show the lifetime as a function of the pion to nucleon ratio. For values relevant for CERN-SPS experiments this ratio is 6 and the lifetime is about 7 fm/c. However, if the pion density is three times the thermal value as suggested by some event generators, the lifetime drops to 1.5 fm/c, making the detection of DCC states e.g. by dileptons [2] impossible.

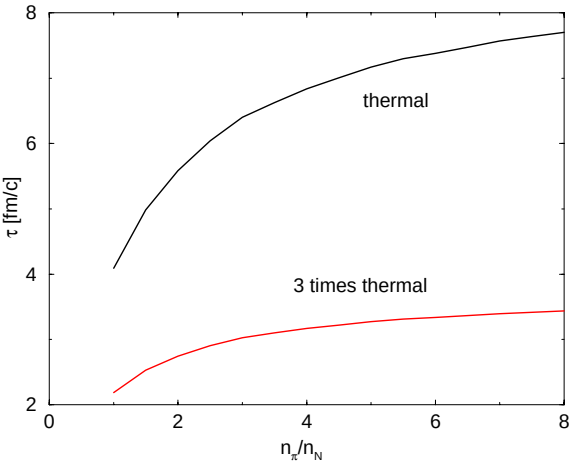

Figure 2: Lifetime as a function of the pion to nucleon ratio.

[1] For a review see: K. Rajagopal in *Quark Gluon Plasma 2* ed. R. Hwa (World Scientific 1995).

[2] Y. Kluger, V. Koch, J. Randrup, and X.N. Wang, Phys. Rev. C **57** 280 (1998)

* LBNL-41593, Phys. Rev. Lett. **81** (1998) 4096

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